Lat 40.29501 Lon -122.23878 77.12

COPY

1976 AND 1977 DROUGHT/PEST-CAUSED TREE MORTALITY IN NATIONAL FORESTS OF NORTHERN CALIFORNIA

A REPORT BY THE FOREST INSECT AND DISEASE MANAGEMENT STAFF

DECEMBER 20, 1977

REGION 5, FOREST SERVICE, U.S.D.A.
630 SANSOME ST., SAN FRANCISCO, CA. 94111

1976 AND 1977 DROUGHT/PEST-CAUSED TREE MORTALITY IN NATIONAL FORESTS OF NORTHERN CALIFORNIA

The following information on tree and volume loss resulting from the two-year northern California drought was gathered by Forest Insect and Disease Management in a combination aerial-ground survey of 12 National Forests in northern California. These results portray the drought loss situation as of May 1977 on 6.3 million acres of commercial Forest Service land in northern California.

FINDINGS

Total Mortality Losses. An estimated 6.5 ± 1.2 million trees with a volume of 3.1 ± 0.7 billion bd. ft. died during the two year 1976-1977 drought. The estimated one-year loss, from May 1976 to May 1977, was 4.5 ± 0.8 million trees with a volume of 1.2 ± 0.3 billion bd. ft.

Loss by Site. (Tables I and II) Site 5 had the highest tree mortality. This confirms observations that large numbers of trees in groups were dying in the dry, southfacing, low-elevation, and marginal sites. But, in terms of volume, the greatest losses in both the two-year drought period and the year ending in May 1977 were on the higher sites (sites 1 and 2 = 68 to 74% of the total volume).

Loss by Forest Type. (Table III) The greatest tree and volume loss during the drought has occurred in the mixed conifer and red fir types of forest (65% of the trees and 78% of the volume). Loss estimates by type for 1977 alone (May 1976 to May 1977) are being computed but are not yet available.

Loss by Species. (Table IV) In the year ending May 1977, the greatest tree and volume loss was in ponderosa and Jeffrey pines. An estimated 80% of the tree and volume loss occurred in 4 tree species: ponderosa and Jeffrey pines and red and white fir.

Pest-Associated Losses. (Figures 1 and 2) Although the current drought was a major factor contributing to these losses, forest insects and diseases were involved in the majority of these losses. For the one-year period May 1976 to May 1977, pests were associated and diagnosed as important contributors to death in 95% of the dead trees, containing 98% of the volume lost. In 69% of the killed trees a combination of an insect and a disease working together under drought conditions were the

cause of death. This type of insect-disease complex was responsible for 67% of the volume loss (See Figures 1 and 2). Insects alone killed 24% of the trees and diseases alone were responsible for 1% of the tree deaths. The major insects involved were the bark beetles (scolytids) and to a lesser degree, but above normal, the flat-headed and round-headed borers. The most damaging diseases were the dwarf mistletoes and root diseases.

These pests played one of two roles in tree mortality. The long-term debilitative diseases (such as root diseases and dwarf and true mistletoes), by weakening the hosts, predisposed them to drought stress. The bark beetles and flat-headed borers attacked and killed trees that were sufficiently stressed by the drought, by pests, and by other factors.

CONCLUSIONS

The current drought has triggered a sharp increase in pest-caused tree mortality in northern California. This increase has occurred on all sites and forest types. The mortality has continued to increase up to this fall and is expected to continue to appear through next spring even if the drought is broken this winter.

FIDM PLANS

1. Evaluate the current high-mortality areas of pine for the possibility of future catastrophic tree losses and need for direct insect control.

2. Interpret the fall 1977 aerial photographs of the drought survey plots for recent tree mortality and compute loss estimates.

3. Cooperate with Timber Management to coordinate a spring aerial sketch-mapping survey of tree mortality for early estimates of spring 1978 loss and for planning salvage operations.

4. Plan and conduct an aerial and ground survey in June 1978 to determine and characterize the drought/pest-caused tree mortality which became visible since fall 1977.

TABLE I

TWO-YEAR DROUGHT MORTALITY ESTIMATES, BY SITE CLASS

1976 & 1977 (TO MAY 1977)

Site Class	No. Of Trees Dead	% Of Total Dead Trees	S.B.F. Volume of Tree Mortality	% Of Total Volume
A	223 ± 144 M	4	498 ± 438 MM	16
1	1,150 ± 346 M	19	1,678 ± 534 MM	54
2	929 ± 253 M	15	431 ± 134 MM	14
3	763 ± 505 M	12	231 ± 122 MM	8
4	427 ± 141 M	7	203 ± 84 MM	7
5	2,543 ± 1,598 M	42	56 ± 22 MM	2
TOTAL	6.5 ± 1.2 million		3.1 ± 0.7 billion	

TABLE II

ONE-YEAR DROUGHT MORTALITY ESTIMATES, BY SITE CLASS

1977 ONLY (May 1976 - May 1977)

Site Class	No. of Trees Dead	% of Total Dead Trees	S.B.F. Volume of Tree Mortality	% of Total Volume
A	52 ± 26 M	1	42 ± 23 MM	3
1	621 ± 217 M	15	624 ± 240 MM	50
2	696 ± 201 M	17	295 ± 93 MM	24
3	549 ± 340 M	14	109 ± 54 MM	9
4	274 ± 108 M	7	125 ± 63 MM	10
5	1,842 ± 1,042 M	46	43 ± 21 MM	4
TOTAL	4,516 ± 812 M		1,239 ± 268 MM	

TABLE III

TWO-YEAR DROUGHT MORTALITY ESTIMATES, BY FOREST TYPE

1976 & 1977 (TO MAY 1977)

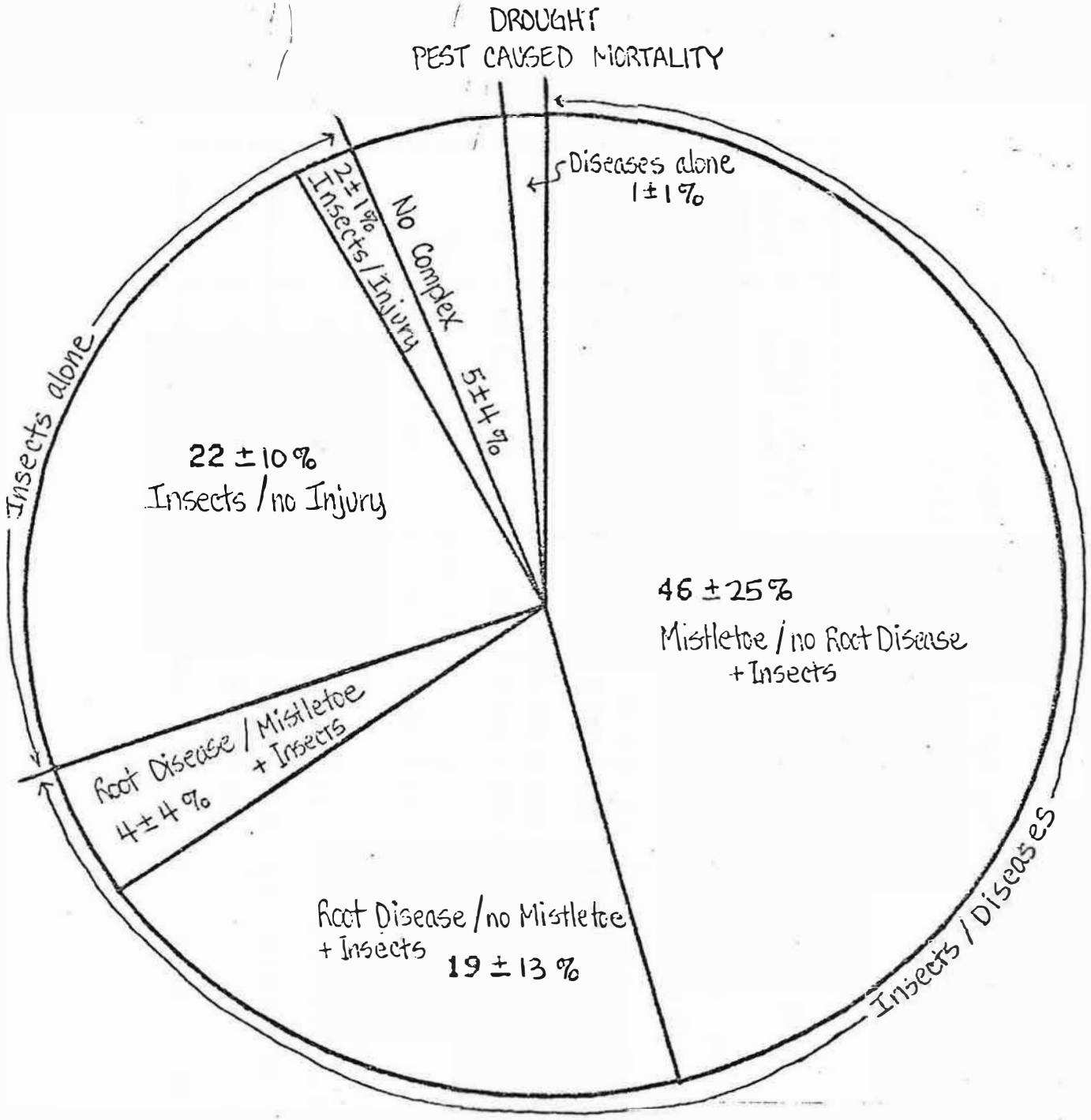
Forest Type	Number Of Trees	% Of Total Trees	S.B.F. Volume	% Of Total Volume
DF	779 ± 355 M	12	462 ± 379 MM	15
MC	3,076 ± 831 M	47	1,571 ± 499 MM	51
RF	1,143 ± 476 M	18	824 ± 290 MM	27
EP	881 ± 491 M	14	96 ± 87 MM	3
P	626 ± 317 M	10	144 ± 58 MM	5

TABLE IV

ONE-YEAR DROUGHT MORTALITY ESTIMATES, BY SPECIES COMPOSITION

1977 ONLY (MAY 1976 - MAY 1977)

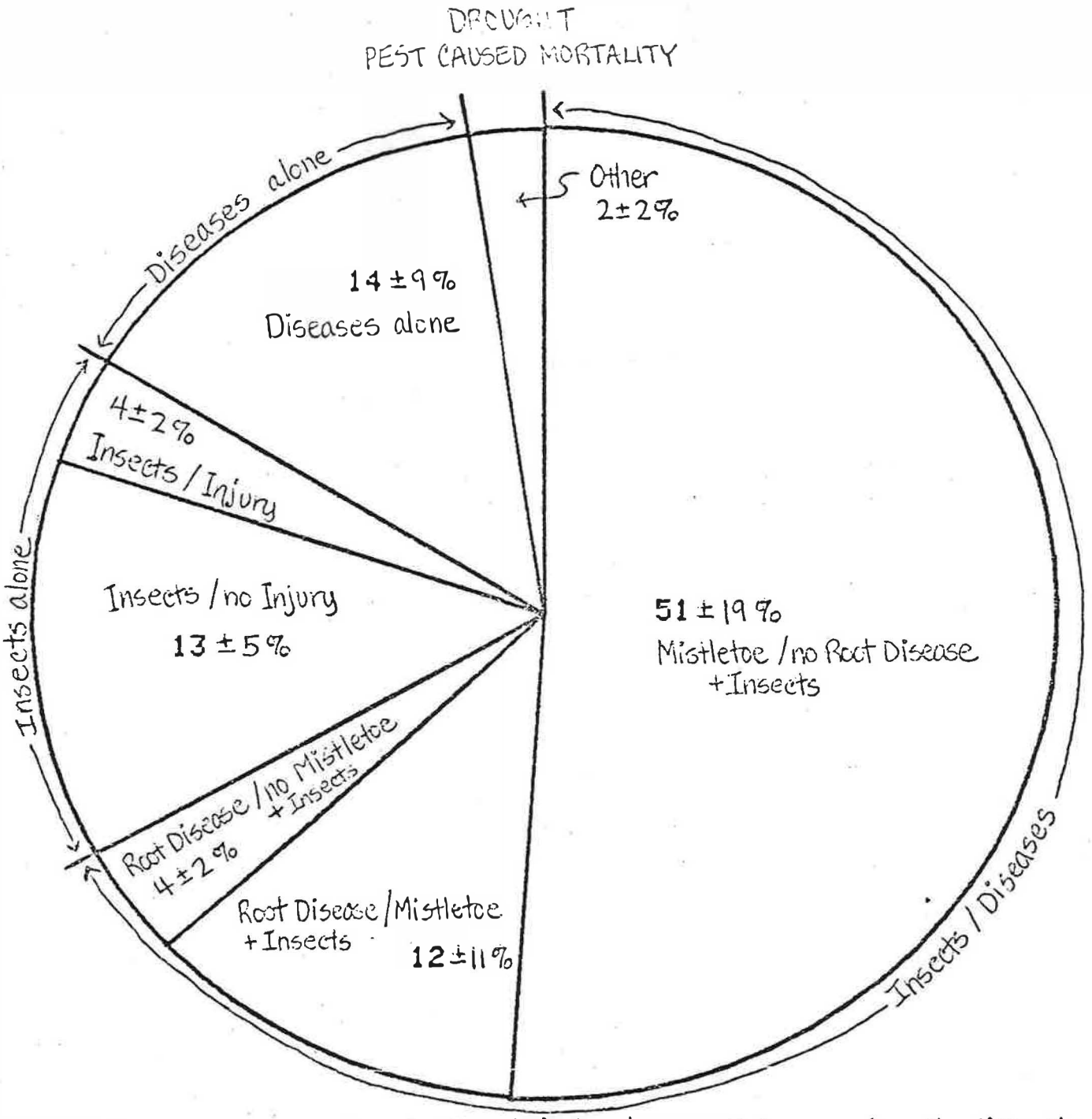
Species	No. Trees Which Died	% Of Total Trees	S.B.F. Volume in Dead Trees	% Total Volume
Ponderosa & Jeffrey Pine	1,819 ± 1029 M	40	497 ± 196 MM	40
Sugar Pine	353 ± 201 M	8	114 ± 73 MM	9
White Fir	1,453 ± 698 M	32	329 ± 135 MM	27
Red Fir	287 ± 108 M	6	222 ± 114 MM	18
Douglas Fir	25 ± 25 M	1	14 ± 14 MM	1
Other	580 ± 367 M	13	62 ± 28 MM	5



12-16-77

Figure 1. Mortality in number of trees, all tree species, May 1976-May 1977.

OFFICIAL GOVERNMENT COPY



12-16-77

Figure 2. Mortality in board-feet volume, all tree species, May 1976 - May 1977.